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M E M O R A N D U M

To: Frank Monahan

From: Bill Yake

Subject: Reichhold Chemicals, Inc., Class II Inspection: 4/21/81

INTRODUCTION

On April 21-22, 1981, a combination source/receiving environment monitoring survey was conducted at Reichhold Chemicals, Inc., Tacoma. This study was the first in a series of specific source-oriented surveys conducted cooperatively by the Washington State Department of Ecology (WDOE) and Region X, USEPA. The particular focus of these surveys is to identify and quantify priority pollutants in facility wastewaters, as well as adjacent surface waters and sediments, in and near Commencement Bay.

Participants in the source survey were: Frank Monahan (WDOE, SWRO), Dan Tangerone (USEPA, Region X), and Marc Heffner and Bill Yake (WDOE). Reichhold Chemicals, Inc., was represented by Bill Green. The receiving water study was conducted by John Bernhardt, Art Johnson, Shirley Prescott, and Joe Joy (WDOE).

Setting

The Reichhold Chemicals facility is located in the Port of Tacoma along Lincoln Avenue between Blair and Hylebos waterways. The plant manufactures a variety of organic and inorganic chemicals, resins, and treated fiberboard products. Specific processes conducted at the site include: 1) formaldehyde production; 2) formaldehyde catalyst production; 3) pentachlorophenol production; 4) butyl phenol production; 5) resin production (including urea formaldehyde, phenol formaldehyde, polyvinyl acetate, polyester and polyurethane foam resins); and 6) manufacture of treated fiber products.

The plant site is depicted in Figure 1. Process wastewaters are routed to a series of four ponds for treatment. Wash down and storm drainage from the general plant site is routed to a pump house, from which it can either be pumped to the pond system or to the city sewer, while wash and storm waters from the north corner of the plant drain to an arm of the peripheral drain ditch. This peripheral ditch drains a "dredged solids disposal area" at thesouth end of the property. During normal conditions, the water in this ditch is essentially static. During storm events, the drain ditch may discharge to the Lincoln Avenue drain and thence to Blair Waterway. If, however, greater than 1 mg phenols/L is detected in the drain ditch, all flow is pumped to the treatment ponds; or, if the treatment capacity of the ponds is exceeded, directly to the Tacoma City sewer.

The treatment facility (Figure 1) consists of four ponds operated in series. Ponds 1 and 4 provide settling, while ponds 2 and 3 have surface aerators and provide biological treatment of the wastewaters. Pond 1 is periodically dredged and the spoils placed in the "dredged solids disposal area" mentioned previously. The capacity of the four ponds is reported to total 2.5 to 3.0 million gallons and have a nominal detention time of approximately 20 to 25 days.

SAMPLING DESIGN

Wastewater samples were obtained at three locations at Reichhold: Aeration pond influent; treated effluent and peripheral drainage ditch water. Details regarding location, timing, and types of samples are included in Table 1. Briefly, analyses for most conventional and priority pollutant constituents were obtained from 24-hour time composite samples obtained with portable ISCO composite samplers provided by USEPA - Region X. Certain analyses (cyanides, one set of phenols, and oil and grease) were conducted on grab samples, while temperature, dissolved oxygen, and pH were determined in the field.

One unique aspect of this investigation was the analysis of a number of "blanks" to assure the quality of reported data. EPA, Region X, Manchester Laboratory provided water which had been deionized and passed through activated carbon, to check the cleanliness of samplng equipment. Aliquots of this "master" water were passed through each of the composite samplers, both in the laboratory and on site (Reichhold) before the sampling commenced. Each of these "blanks" were analyzed for organic and metallic priority pollutants. Results were reviewed for indications of contamination and, when appropriate, final results modified to account for possible contamination.

Analyses were performed at three laboratories (see Table 1).

During the sample period, no effluent was being discharged over the V-notch weir from the peripheral drain ditch. A very small flow was trickling around the weir plate, but this flow was too small to be quantified. The quantity of flow being discharged from the treatment system to the Tacoma sewer was gaged by the Reichhold flow totalizer upstream of the effluent V-notch weir. An instantaneous check of flow meter accuracy, using simultaneous head height measurement, indicated meter accuracy within the 15 percent criterion (Table 1).

RESULTS AND DISCUSSION

The following section discusses observations and results in three general areas:

1) Compliance with the current permit including suggestions for permit revision.

2) Findings with regard to specific pollutions including organics, metals, cyanide, and ammonia.

3) Reichhold sampling and analysis procedures with respect to fulfilling self-reporting obligations (DMRs).

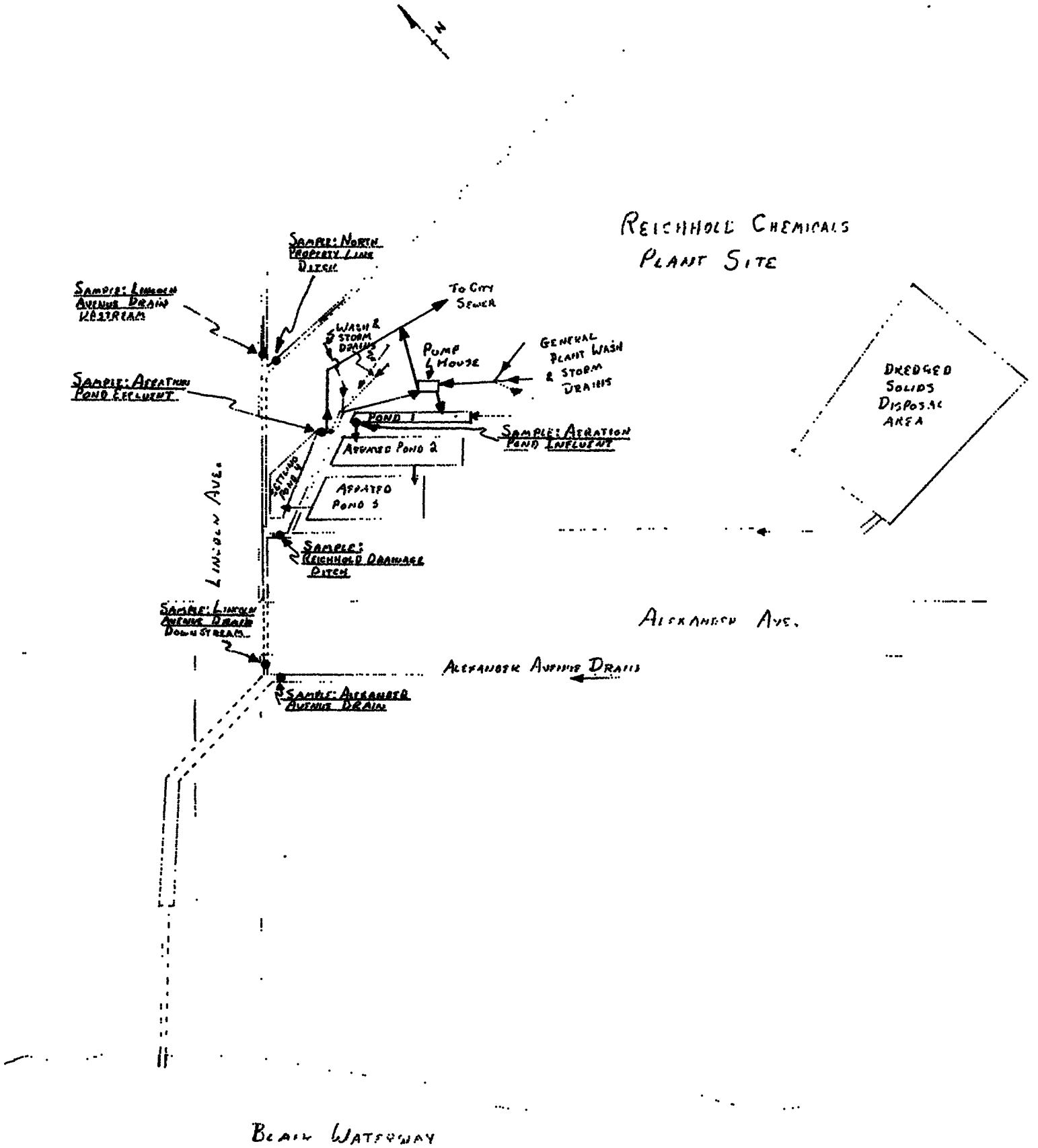
N
REICHHOLD CHEMICALS
PLANT SITE
SAMPLE: NORTH PROPERTY LINE DITCH
SAMPLE: LINCOLN AVENUE DRAIN UPSTREAM
SAMPLE: AERATION POND EFFLUENT
TO CITY SEWER
WASH & STORM DRAINS
PUMP HOUSE
GENERAL PLANT WASH & STORM DRAINS
POND 1
AERATED POND 2
AERATED POND 3
SETTLING POND
SAMPLE: AERATION POND INFLUENT
SAMPLE: REICHHOLD DRAINAGE DITCH
LINCOLN AVE.
SAMPLE: LINCOLN AVENUE DRAIN DOWN STREAM
ALEXANDER AVE.
ALEXANDER AVENUE DRAIN
SAMPLE: ALEXANDER AVENUE DRAIN
DREDGED SOLIDS DISPOSAL AREA
BEAIN WATERWAY

Figure 1

TABLE 1. LABORATORIES PROVIDING ANALYTICAL SERVICES

CONSTITUENTS	RESPONSIBLE AGENCY	LABORATORY
Oils & Grease, Phenols, COD, pH, Formaldehyde, Salinity, Conductivity, Solids, Nutrients, Metals	WDOE	WDOE, Tumwater (except for Mercury and Formaldehyde, Redmond)
Cyanide	EPA	EPA, Region X, Manchester
Organic Priority Pollutants, other organic constituents	EPA	West Coast Technical Services, Inc.

AV/W1(B9)

TABLE 2. SAMPLE INFORMATION

Composite Sampler - Locations

SAMPLER	DATE AND TIME INSTALLED	LOCATION
1. Aeration Basin Influent	04/21/81 - 1340	#1 Pond at Effluent Structure
2. Aeration Basin Effluent	04/21/81 - 1105	#4 Pond Effluent above V-Notch Weir
3. Peripheral Drain	04/21/81 - 1415	Storm Ditch, approx. 10 ft. above V-Notch Weir

Field Analysis - Dates and Times

SAMPLE LOCATION	DATE AND TIME	ANALYSIS
1. Aeration Pond Influent	04/21/81 - 1345	pH, Temperature
2. Aeration Pond Influent	04/22/81 - 1310	pH, Temperature, D.O.
3. Aeration Pond Effluent	04/21/81 - 1045	pH, Temperature, D.O.
4. Aeration Pond Effluent	04/22/81 - 1055	pH, Temperature, D.O.
5. Storm Drainage Ditch	04/21/81 - 1410	pH, Temperature
6. Storm Drainage Ditch	04/21/81 - 1430	D.O.
7. Storm Drainage Ditch	04/22/81 - 1345	pH, Temperature

Grab Samples - Dates and Times

SAMPLE LOCATION	DATE AND TIME	ANALYSIS
1. Aeration Pond Influent	04/21/81 - 1400	Phenols, Oil & Grease, Cyanides
2. Aeration Pond Effluent	04/21/81 - 1125	Phenols, Oil & Grease, Cyanides
3. Peripheral Drain	04/21/81 - 1435	Phenols, Oil & Grease, Cyanides

Flow Calibration Check - Pond Effluent Weir - 60°

DATE & TIME	REICHHOLD SCRIPT CHART	MEASURED FLOW	% ERROR
04/21/81 - 1130	72 gpm	83 gpm	-13.3%
04/22/81 - 1105	85 gpm	83 gpm	+ 2.4%

AV/W1(B10)

Compliance with Effluent Limitations.

NPDES waste discharge permit No. WA-000156-2, setting conditions for Reichhold's discharge of wastewater, expired on March 31, 1980. It was extended by letter on April 10, 1980, pending publication by USEPA of standards for "Best Available Technology" for control of toxic pollutants. This extention of the expired permit is currently in effect, as the above-mentioned standards are still pending. In addition, an Order, Docket No. DE 79-227, was issued June 27, 1979. It appears, however, that this order does not substantially alter the conditions of the original permit. Specifically, although Reichhold is striving to prevent the discharge of storm waters with greater than 1 mg/L phenols by rerouting these waters to the treatment system or the Tacoma sewer system, there appears to be no documentation requiring this. For this and additional reasons discussed later, a modification of the permit may be in order.

For the purposes of this inspection, permit compliance is assessed in reference to the extended permit. Table 3 compares results from this inspection with permit limitations. In addition, the results of formaldehyde analyses are noted and phenol and specific phenol derivitives detected in effluent and peripheral drainage ditch samples are tabulated. During the sample period, the discharge was meeting permit limitations. The only constituent approaching permit limitations was chemical oxygen demand (COD) in the treated effluent which was present at 900 mg/L, compared to a limitation of 1,000 mg/L.

In addition to effluent analyses required by the NPDES permit, Reichhold tests for and reports formaldehyde concentrations in their treated wastewater. The test procedure used by Reichhold is a sodium sulfite method. Samples taken during this inspection were analyzed by the WDOE Tumwater laboratory using this method, and by WDOE Redmond laboratory using an adaptation of a method for formaldehyde in air using Schiff reagent. There are no methods specified for formaldehyde analysis in the sources specified in NPDES permits (i.e., ASTM, EPA, or Standard Methods). Although results for the two types of analyses agreed for the treatment system influent (Table 4), there were substantial discrepancies on the effluent and peripheral drain samples (tables 3 and 4). The source of these discrepancies is not clear but may have been due in part to the fact that over a week elapsed between sample collection and analysis at the Redmond lab, while analysis at the Tumwater lab was performed the day after sample collection. Because available information indicates that formaldehyde is toxic to aquatic organisms in the 20 to 50 mg/L range (California State Water Quality Control Board, 1963), and concentrations within and above this range are commonly reported in the treated effluent, it may be wise to require monitoring of peripheral drain waters for formaldehyde and providing a limitation for this constituent in any discharge to the Lincoln Avenue drain.

TABLE 3. PERMIT COMPLIANCE

CONSTITUENTS	PERIPHERAL DRAIN DITCH			TREATED EFFLUENT		
	WDOE Results	EPA Results	Permit Requirements	WDOE Results	EPA Results	Permit Requirements
Flow (MGD)	0		1.4[1] 2.0[2]	.117		.30[2]
Temperature (°C)	12.7* 13.4*		18.9[2]	12.6 12.7*		-
pH (S.U.)	7.1 7.6* 7.2*		6.5 - 8.5	7.9 7.6* 8.0*		6.5 - 8.5
COD (mg/L)	210.		-	900		1000[2]
Formaldehyde	38[a] 10[b]		-	20[a] 0.6[b]		-
Recoverable Phenolics as Phenol (mg/L)	.15+ .18		-	.031+ .034		1.0
Phenol (mg/L)		.028			ND	
2-Chlorophenol (mg/L)		.068			ND	
4-Chlorophenol (mg/L)		P			ND	
2,4-Dichlorophenol (mg/L)		.025			ND	
2,4,6-Trichlorophenol (mg/L)		.015			ND	
2,3,4,6-Tetrachlorophenol (mg/L)		P			ND	
Pentachlorophenol (mg/L)	.240	.182			P	
2,4-Bis(1,1-Dimethyl,ethyl) phenol (mg/L)		ND		.390	.800 P	

AV/W1(B11)

* - Field Analysis
\+ - Grab Sample

1 - Daily Average
2 - Daily Maximum

a - Sulfite Titration Method
b - Schiff Reagent Method

P - Tentatively identified as present, not quantified
ND - None Detected

TABLE 4. WDOE FIELD AND LABORATORY RESULTS - REICHHOLD CHEMICALS

CONSTITUENTS	AERATION BASIN INFLUENT		AERATION BASIN EFFLUENT			STORM DRAINAGE DITCH		
	Composite	Grab	Composite	Grab	Permit Limits Daily Maximum	Composite	Grab	Permit Limits Daily Maximum
Flow (MGD)	(.117)		.117		.300	0		1.4
COD (mg/L)	2000		900		1000	210		-
Oils & Grease (mg/L)		17		3	-		<1	15
Recoverable Phenolics as Phenol (mg/L)	90	48	.034	.031	1.0	.18	.15	-
Pentachlorophenol (mg/L)	1.260		.800			.230		
pH (S.U.)	10.0	10.4* 9.6*	7.9	7.6* 8.0*	6.5 - 8.5	7.1	7.6* 7.2*	6.5- 8.5
Temperature (°C)		17.5* 17.9*		12.6* 12.7*			12.7* 13.4*	18.9
Formaldehyde (mg/L)	308[1] 270[2]		38[1] 10[2]			19.7[1] 0.6[2]		
Salinity (°/00)	1.7		4.2			3.2		
Conductivity (umhos/cm)	2900	3300* 3420*	6670	7500* 7800*		5240	5300* 5500* 6800*	
Total Solids (mg/L)	2300			4600			3700	
Tot. Non-Vol. Solids (mg/L)	1700			3700			2700	
Tot. Sus. Sol. (mg/L)	16			27			33	
T. N.V. S.S. (mg/L)	3			6			12	
NH_3-N (mg/L)	37.5			65			30	
NO_2-N (mg/L)	<.05			<.05			<.025	
NO_3-N (mg/L)	1.0			<.05			.125	
O-PO_4-P (mg/L)	<.10			.90			<.10	
T-PO_4-P (mg/L)	.25			2.9			.25	
Diss. O_2 (mg/L)		10.4*		1.25* 3.5*			30.8*	
As (ug/L)	<5		<5			<5		
Cd (ug/L)	7		12			12		
Cr (ug/L)	INT.		79			36		
Cu (ug/L)	97		16			36		
Hg (ug/L)	<.2		<0.2			0.4		
Mo (ug/L)	23000		16300			1800		
Ni (ug/L)	INT		INT			86		
Pb (ug/L)	INT		INT			INT		
Zn (ug/L)	42		29			85		

*Field Test

1 - Sodium Sulfite Method
2 - Schiff Reagent Method

INT - Interference

AV/W1(B13-15)

Specific Priority Pollutants.

Organics: Influent, effluent and storm drain samples were analyzed for the 114 organic priority pollutants. Concentrations of detected pollutants are noted in Table 4a. This table also includes the results of earlier analyses of Reichhold wastewaters, including Reichhold consolidated permit analyses and EPA's analyses of sample peripheral drain water collected in September of 1980. In addition to priority pollutants, several additional organic chemicals were reported as tentatively identified in the wastewater samples. Although these tentatively identified chemicals were not quantified, their presence is noted in tables 4a and 4b.

The phenol, chlorinated phenol, and phenol derivitive compounds constitute what is probably the most characteristic and important class of chemicals in Reichhold's wastewaters. There are difficulties in drawing broad conclusions about the efficiency of the treatment system based data from a single day, particularly considering the 20- to 25-day detention time of the system. None-the-less, it appears that when the system is operating properly (healthy biomass, adequate detention time), it is quite effective in reducing concentrations of phenol and the mono-, di-, and tri-chlorinated phenols. This is consistent with findings that this class of chemicals undergo both photodegradation and microbial degradation (EPA, 1980). On the other hand, it appears that the treatment system is less effective in degrading pentachlorophenol, and possibly tetrachlorophenol. Pentachlorophenol was present in higher concentrations than any other phenol derivative in both treated effluent and peripheral drain samples (tables 3 and 4a). Table 5 compares concentrations of priority pollutants found in the peripheral drain sample to available EPA criteria. Note that pentachlorophenol was found in concentrations approximately 3 to 60 times the criteria for protection of aquatic life. Based on this, it appears that permit limitations for pentachlorophenol should be considered for the peripheral drain discharge to the Lincoln Avenue drain and Blair Waterway.

Few other organic priority pollutants were noted in the treated effluent, but several were found in peripheral drain waters in moderate concentrations including trichlorofluoro methane; 1,2 dichloroethylene, trichloroethylene, vinyl chloride and the nonpriority organic solvent methylethyl ketone. As noted in Table 5, the first three of these pollutants are somewhat carcinogenic. However, considering the probable infrequency of discharge, it is likely that these wastewaters bear little or no responsibility for biological abnormalities in Commencement Bay. Annual sampling and analysis for the priority pollutants listed above should be considered.

Metals: The analytical results for trace metals indicate that Reichhold wastewaters have generally low metals concentrations. The only exception to this was molybdenum which was present in high concentrations. There are no EPA criteria for molybdenum and the California State criteria document (1963) notes adverse effects at the 36 to 47 mg/L level which is approximately double the concentrations in Reichhold wastewaters Molybdenum may have some value as a tracer of Reichhold wastewaters in this and following studies.

Cyanide: EPA Region 10 laboratories analyzed samples for cyanide. The reported concentrations are given in Table 4a. As noted, the values reported for the treatment plant influent and effluent (50 and 200 ug/L, respectively) were tentative. Response peaks on the test were small and subsequent sample spiking revealed marked supression of cyanide recovery, particularly in the effluent sample. Reported results account for this supression. John Falkowski, Reichhold Chemicals, stated that Reichhold does not use cyanide in any of their chemical processes. It is possible that their was no cyanide in the samples and that the peaks were analytical interferences.

Ammonia: The most striking result in the other conventional analyses was the high concentration of ammonia at all three sample locations (30 to 65 mg NH_4-N/L) as shown in Table 4. Unionized ammonia (NH_3) is toxic and EPA has set a criterion of .017 mg NH_3-N/L for unionized ammonia in surface waters for the protection of aquatic organisms. Unionized ammonia concentrations in the peripheral drain waters were in the 0.14 to 0.27 mg NH_3-N/L range. Depending on the amount of water and flow in the Lincoln Avenue ditch and the pH and temperatures of both the discharge and the ditch waters, the criterion may, on occasion, be exceeded in the Lincoln Avenue drain ditch.

Sample Collection and Analysis.

Sample Collection: Reichhold has Madden diaphragm pump composite samplers at each of the three locations sampled during the survey. Formaldehyde, phenol, COD, and pH tests are run on aliquots of these samples. Samples are not iced or refrigerated during collection. The samplers themselves are cleaned monthly and the 5-gallon sample buckets are kept for several months and then thrown away. Reichhold personnel mentioned that during the summer and winter, pump delivery must be increased to prevent sample line clogging. Algae and bacteria clog the lines in the summer, ice in the winter. Increasing the sample pump flow results in sample buckets filling in about eight hours, then overflowing for 16 hours. Also mentioned was the fact that the sample buckets can accumulate a substantial amount of "sludge" prior to being replaced.

The existing sample collection system is not adequate. Lack of refrigeration, sample line cleaning and sample bucket cleaning, all are expected to result in sample degradation. The existing system should be reviewed with Reichhold and modified. Samplers with purge cycles, adequate sample line velocities, and refrigeration would provide a much more adequate system. In any case, composite samples buckets (or jugs) should be cleaned after each use. Scrubbing with hot water is recommended.

At the time of the survey, no mechanism was available for sampling general plant spills and runoff which flow directly to the pump station. This sampling equipment is now installed, however this source sample is not currently addressed in the discharge permit.

TABLE 4a. COMPARISON OF PRIORITY POLLUTANT ANALYSES FOR REICHHOLD WASTEWATERS

CONSTITUENT (Units = ug/L)	AERATED LAGOON INFLUENT	AERATED LAGOON EFFLUENT		STORM DRAIN EFFLUENT		
	Present Study 4/21/81	Reichhold Consol. Permit App. 3/80	Present Study 4/21/81	EPA Study 9/23/80	Reichhold Consol Permit App. 3/80	Present Study 4/21/81
Metals						
As	<5	<10	<5	4		<5
Cd	7	1	12	0.5		12
Cr		5	79	<1		130
Cu	97	26	16	3		36
Hg	<0.2	<10	<0.2	0.7		0.4
*Mo	23,000		16,300			1,800
Ni		<20		23		86
Pb		<10		2		
Zn	42	480	29	40		85
Recoverable Phenolics (as Phenol)	90,000/48,000	up to 204,000	34/31		up to 1000	180/150
Phenol	42,150	<25	N.D.		35	28
2-Chlorophenol	850	<25	N.D.		<25	68
*4-Chlorophenol	N.D.		N.D.			P
2.4-Dichlorophenol	380	<25	N.D.		<25	25
2,4,6-Trichlorophenol	315	24	N.D.		<25	15
*2,3,4,6-Tetrachlorophenol	N.D.		P			P
Pentachlorophenol	1,260	2,100	800		230	182
*2,4-Bis(1,1-Dimethyl Ethyl) Phenol	N.D.		P			N.D.
*3-(1,1-Dimethyl Ethyl) Phenol	P		N.D.			P
Carbon Tetrachloride	3	<10	N.D.	N.D.		N.D.
Trichlorofluoromethane	2,744	<10	12			320
*Dichlorofluoromethane	N.D.		N.D.			P
Chloroform	172	<10	N.D.	7.2		2
*Acetone	P*		N.D.			P*
*Methylethyl Ketone	N.D.		N.D.			238
1,1-Dichloroethane	N.D.	<10	N.D.	N.D.		N.D.
1,1,1-Trichloroethane	12	<10	N.D.	1.2		8
1,2-Dichloroethylene	N.D.	<10	N.D.	4.4		232
Trichloroethylene	22	<10	N.D.	50		422
Benzene	22	<10	N.D.			N.D.
Ethyl benzene	16	<10	N.D.			N.D.
1,2 dichlorobenzene	N.D.	<10	N.D.	5.4		N.D.
Toulene	12	<10	7			3
Vinyl chloride	N.D.	<10	N.D.			161
Cyanide	50t		200t			<5

AV/W1(17-18)

* = Not priority pollutant
P = Tentatively identified as present, not quantified.
P* = Present in sample but contamination of blanks precludes quantification.
t = Due to interferences, these values are approximations.

TABLE 4b. ADDITIONAL ORGANIC CHEMICALS TENTATIVELY IDENTIFIED IN SAMPLES

CONSTITUENT	AERATION BASIN INFLUENT	TREATED EFFLUENT	PERIPHERAL STORM DRAIN
Dimethoxymethane	P		
2-Ethoxy, 2-Methyl Propane	P	P	P
1,3,5,7-Tetra Agatricyclo (3,3,1^{3,7}) decane		P	
2-Methylpropanal		P	
2-Methyl, 2-Propanal	P		
2-Methyl, 2-Butenal	P		
2-Methyl, 2-Pentenal	P		
2,2-Dimethylpropanoic Acid		P	
Butylester, 2-Propanoic Acid	P		
1-Butanol	P		
2-Ethyl, 4-Methyl, 1,3-Dioxolane	P		
Dimethyl 1,4-Dioxane		P	

AV/W1(B20)

TABLE 5. COMPARISON OF SELECTED PRIORITY POLLUTANT CONCENTRATIONS TO EPA CRITERIA
(ug/L units)

CONSTITUENTS	PERIPHERAL DRAIN SAMPLES	WATER QUALITY CRITERIA									
		AQUATIC LIFE								HUMAN HEALTH FOOD INTAKE (FISH)	
		Freshwater				Salt Water					
		Criteria		Sample/Criteria Ratio		Criteria		Sample/Criteria Ratio		Criteria	Sample/Criteria Ratio
		Acute	Chronic	Acute	Chronic	Acute	Chronic	Acute	Chronic		
Phenol	28	10,200	2,650	.003	.011	5,800	UNK	.005	UNK		
2 Chlorophenol	68	4,380		.016						-	-
2,4 Dichlorophenol	25	2,050	.365	.012	.068	UNK	UNK	UNK	UNK	-	-
2,4,6 Trichlorophenol	15		(970)		(.015)					3.6*	4.2
Pentachlorophenol	182	55	3.2	3.3	57	53	34	3.4	5.4	(29.4×10^{6}t)	(6.2×10^{-6})
Trichlorofluoromethane	320	11,000	UNK	.029	UNK	12,000	6,400	.027	.050	15.7*	20
Trichloroethylene	422	45,000	21,900	.009	.019	2,000		.21		80.5*	5.2
Vinyl Chloride	161	35,200	UNK	.005	UNK	50,000	UNK	.003	UNK	6.94*	23

AV/W1(B22-23)

UNK = Unknown

* = 1 additional cancer in 10^{6} exposures

t = based on toxicity

( ) = concentrations mentoned in criteria documents but not in Federal Register

|____| = Ratios >1

TABLE 6. COMPARISON OF SAMPLING AND SAMPLE ANALYSES

CONSTITUENT	AERATION POND INFLUENT		AERATION POND EFFLUENT		PERIPHERAL DRAIN	
	Reichhold	WDOE	Reichhold	WDOE	Reichhold	WDOE
Phenol (mg/L)	101.5[1]	90[+]	0.2[1]	.034[+]	.23[2]	.18[+], .15[*]
COD (mg/L)	2043[3]	2000[+]	391[1]	900[+]	-	210[+]
Formaldehyde (mg/L)	234[3]	308[+]	69[1]	38[+]	-	19.7[+]
pH	11.4[1]	10[+]	7.9[1]	7.9[+]	7.7[2]	7.2*, 7.6*

AV/WI(B29)

1 = Reichhold 24-hr. composite sample - 4/21 (0700) to 4/22 (0700)

2 = Reichhold grab sample - 4/21

3 = Reichhold 4-day composite samples - 4/20 (0700) to 4/23 (0700)

+ = WDOE 24-hr. composite sample 4/21-4/22 (see Table 2 for times)

* = WDOE grab sample - 4/21 (see Table 2 for times)

Temperature measurements are obtained from the peripheral ditch water whenever discharge is occurring. The permit requirment for this is a throwback to an earlier time when cooling water was regularly discharged. Heated water is now discharged infrequently, only when the cooling tower is being bypassed, and cooling water is not being recycled. The permit might be modified to require temperature reporting only when cooling water is being discharged.

Laboratory Analysis: Because there was not enough sample volume to split WDOE samples with Reichhold for analysis, we can only compare our analytical results with Reichhold's analysis of samples taken by Reichhold personnel at approximately the same time. Table 6 compares these results. In general, agreement in results is adequate. As mentioned previously, the standard references for water and wastewater analysis (EPA, Standard Methods, ASTM) do not address formaldehyde analysis. It should be noted that although Reichhold has compared the sulfite and chromotropic acid methods and found acceptable agreement, ketones (especially, methyl ketones, which are found in plant samples as methylethyl ketone) can create a positive interference with the sulfite test. Based on all results reported here, it appears that, if anything, the sulfite test may tend to overestimate formaldehyde concentrations.

The major discrepancy was noted for the COD analysis on the treated effluent sample. Although the WDOE lab value of 900 mg/L is substantially higher than concentrations reported by Reichhold, the raw data and calculations for this analysis were checked, and there is no reason to suspect an error. On August 4, three and one-half months after sample collection, an aliquot of this sample retained for metals analysis was rerun for COD and a value of 450 mg/L obtained. Therefore, although the sample was stored for a long period of time and preserved with HNO_3 (an oxidizing acid which would have likely been responsible for some COD oxidation) the concentration obtained was still higher than Reichhold's result. The reason for the discrepancy is not clear.

CONCLUSIONS AND RECOMMENDATIONS

During this survey, there was little or no direct discharge of Reichhold effluents to inner Commencement Bay. The indirect impact, including seepage and discharge by way of the Tacoma Wastewater Treatment Plant, will be investigated and reported in later surveys and reports.

The treatment facility at Reichhold was operating well and appeared to be achieving good reduction of formaldehyde, phenol, and the chlorinated phenols with the exception of pentachlorophenol and possibly tetrachlorophenol. Several additional priority pollutants were quantified in the peripheral drain sample in the 100 to 500 ug/L range. These included trichlorofluoromethane, 1,2 dichloroethylene, trichloroethylene, vinyl chloride and the nonpriority pollutant, methylethyl ketone. The Reichhold discharge was meeting all current permit limitations.

The redrafting of the permit has been delayed pending the development and publication of "Best Available Treatment" guidelines by USEPA. When the permit is redrafted the following points should be considered:

I. Peripheral Drain (Main) Effluent:

A. Consider inclusion of pentachlorophenol and formaldehyde limitations.

B. Consider annual analysis for previously identified priority pollutants.

C. Require temperature measurement and reporting only during periods of cooling tower bypass.

II. General Plant Wash Down and Storm Drainage Pumped Directly to the Tacoma Sewer System

A. Consider inclusion of sampling and analysis of this wastewater when it is being discharged to the Tacoma sewer system.

III. Treated (Pond 4) Effluent

A. Consider inclusion of analysis requirements for formaldehyde and pentachlorophenol.

B. Consider annual analysis for priority pollutants.

In light of current problems with Reichhold's samplers (lack of refrigeration and adequate cleaning) and any pending permit changes in required sample analyses, changes in sampling procedure should be addressed. Intake velocities, refrigeration, ease of sample line and sample container cleaning, and requirements for correct priority pollutant sampling and analysis should be considered.

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REFERENCES

1. State Water Quality Control Board, Resources Agency of California, 1963. Water Quality Criteria, 2nd Edition.

2. EPA, 1980. Ambient Water Quality Criteria for Chlorinated Phenols. EPA 440/5-80-032.